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ALTERNATIVE SOURCES OF ENERGY FOR AGRICULTURE.

The Department of Agriculture is pleased to have been asked to cosponsor this important technology transfer opportunity for those interested in solar irrigation.

And I am pleased to have been asked to address you on the subject of the USDA's energy programs, even though the Department's present direct involvement in solar irrigation research and development is minimal.

This workshop may well change the course of events and result in increased interest on the part of Agricultural Research Service and State land-grant university Agricultural Experiment Stations in conducting solar irrigation research--and thus, perhaps, at least one goal of the workshop's organizers eventually may be achieved.

Speaking of the workshop's organizers, I'd like to thank Conference Chairman Lyle Wetherholt and the other Energy Research and Development Administration and Sandia Laboratories staff members--and Earl Gavett of our own Economic Research Service--for shouldering the conference administration details. For that matter, I'd also like to thank our ERDA and Sandia friends for the informal assistance they give USDA scientists on a continuing basis.

Although the ongoing effort is impressive, the Department of Agriculture has just scratched the surface of its potential role in

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Remarks of Dr. M. Rupert Cutler, Assistant Secretary of Agriculture for Conservation, Research, and Education, at the Solar Irrigation Technical Workshop, Albuquerque, New Mexico, July 7, 1977.

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energy research, development, and demonstration. In response to encouragement from the President, the Secretary of Agriculture, and the Congress, USDA agencies now are placing more emphasis on energy-related programs.

Zero-based budgeting has stimulated the restructuring of our agencies' budgets to surface "decision units" which are not only descriptive of what the agencies do, but which can be equated with departmental missions and high-priority programs of the Administration such as energy. A new administrator for the Federal Extension Service, who will give energy educational programming special attention, reports for duty next week. That's Dr. Neill Schaller, formerly of the Farm Foundation.

In short, I'm here to report to you that your Department of Agriculture has gotten the message regarding how important the energy crisis is, particularly to farmers, and is organizing to give the issue the kind of research and technology transfer attention it deserves and must have.

It would have been hard for us not to have gotten the message. Beyond all the signals we've received as individuals--such as the doubled price of fuel oil, which led me to sell my house in East Lansing last year and move into a townhouse apartment--official policy pronouncements on the subject have been loud and clear.

President Carter, on April 18, 1977, called on the American people to meet the challenge of the energy crisis with sacrifice, hard work, skill, and imagination, stressing that "This difficult effort will be 'the moral equivalent of war'--except that we will be uniting our efforts to build and not to destroy." The National Energy Plan produced

by the President's Energy Policy and Planning Office is designed to prepare the United States for a period of growing oil stringency predicted to begin in 1985. I'm glad to report that it does not seek illusory goals, such as energy independence. It does call for the creation of a unified Federal Department of Energy "to avoid the inconsistencies and uncertainties inherent in a situation where agencies operate in isolation and sometimes at cross-purposes." The new department will "coordinate [Federal energy] research, development, and commercialization activities."

The President's National Energy Plan, released on April 29, recognizes that an effective Federal research, development, and demonstration program is indispensable for the production of new energy sources. . . but stipulates that the Government will not support energy technologies that do not meet technical, economic, national security, health, safety, and environmental criteria.

The Plan's research and development program includes financial incentives and public education designed to help launch the solar heating industry--applicable to crop drying and other agricultural applications--and to stimulate more widespread use of technologies which make indirect use of solar energy--such as wind and agricultural and forestry residues, called "biomass."

In summary, we have been directed by the President to "take all reasonable steps to foster and develop" nonconventional energy sources.

As we move down the road, let's remember that the Plan also stipulates that national policies for the protection of the environment must be maintained, and that the "cornerstone" of National Energy Policy is that "growth of energy demand must be restrained through conservation and improved energy efficiency."

Secretary of Agriculture Bob Bergland, responding both to the President's directives and to expressions of concern from the food and fiber industry regarding the increasing cost of essential energy inputs, has made energy a top-priority program in USDA by placing Deputy Secretary John White in charge of stimulating and coordinating energy conservation, research, development, and demonstration efforts throughout the Department. The direct responsibility for research and extension coordination falls to me, but other assistant secretaries in USDA have key roles also, such as the Assistant Secretary for Rural Development, Alex Mercure, formerly of the University of New Mexico, whose responsibility for the Farmers Home Administration and the Rural Electrification Administration has enabled him to organize a rural home energy conservation program--essentially, an insulation, or weatherization, program--in cooperation with rural electric cooperatives with loans provided through FmHA.

The USDA agencies for which I'm responsible--the Agricultural Research Service, the Cooperative State Research Service, the Extension Service, the Forest Service, the Soil Conservation Service, and the National Agricultural Library--all have important roles to play in the implementation of the President's Energy Plan.

Therefore, it's appropriate that the Department of Agriculture be represented here and understandable that I'm happy to meet with you this evening. There are many additional reasons for USDA involvement.

Our farms and forests are the best examples of the use of solar energy, as they absorb it and convert it into chemical energy suitable for human and animal consumption. Our farms and ranches--agriculture--actually are a renewable source of energy, in contrast to our coal mines or natural gas and oil wells.

While agriculture on-farm usage accounts for only about 3 percent of the Nation's total energy usage, agriculture uses about 17 percent of the total liquified petroleum L.P. gas. As papers presented earlier today noted, about 13 percent of all energy used in farm production, including energy used in manufacture of fertilizer and pesticides, is for pumping irrigation water. This production cost problem has brought us together to share experiences and approaches, as we embark on a new venture to more effectively utilize the vast and continuing power supply available to us from the sun.

In this context, I'm looking forward to the dedication of the working solar irrigation pump installation at Willard, New Mexico, tomorrow, and only regret that the Department of Agriculture did not join in the initial sponsorship of this exciting project with ERDA, the Four Corners Regional Development Commission, and the State of New Mexico.

I am pleased to report, however, that the Edgewood Soil Conservation District was the contractor employed to construct the reservoir associated with the Willard solar irrigation pump, that USDA's Soil Conservation

Service laid out the reservoir and provided necessary engineering technical assistance, and that Cooperative Extension Service county staff members helped ERDA find a landowner interested in offering his farm as the location for this experimental solar irrigation project.

On April 15, 1977, Secretary of Agriculture Bob Bergland signed a Memorandum of Understanding between the U.S. Department of Agriculture and the Energy Research and Development Administration. It is the purpose of this Memorandum of Understanding to formalize the working relationship between USDA and ERDA by identifying broad principles and policies of cooperation between the two agencies in energy research, development, and demonstration and Extension education. I shall press for prompt appointment of the ERDA-USDA Steering Committee and early implementation of the effort called for in this Memorandum to plan, fund, direct, and conduct a National Program of Agricultural Energy Research, Development, and Demonstration. ERDA and USDA interpret the legislation relating to each agency to mean that they share responsibilities for ensuring the advancement and consideration of new energy conservation technologies and the development of new energy sources and systems for agriculture, and from agriculture. These responsibilities include finding ways to accomplish their respective missions, consistent with soundly formulated environmental constraints.

The policy of the two agencies is aimed at meeting these goals:

-- Reduction of energy consumption per unit of output in production, processing, marketing and utilization aspects in the food, fiber, and forestry sectors. About 5 percent of the Nation's energy is used in processing food.

- Efficient use of energy in rural living.
- Substitution of renewable or noncritical for scarce forms of energy.
- Development and production of energy from biomass of agricultural and forest materials.
- Prevention of adverse impacts from energy production and use.

How have the USDA's agencies addressed today's energy challenge?

The Agricultural Research Service is directing approximately \$10.3 million into 140 projects related directly to energy research for agriculture. Fifty-eight of these energy projects involve solar energy. They include research and demonstration involving solar-heated farrowing houses, greenhouses, combination greenhouse-tobacco-curing barns, low-cost solar-heated rural residences, grain-drying binds, and irrigation, to name some of the major projects.

The 58 projects are examples of cooperation between ARS and other agencies doing research. Fourteen are in ARS laboratories; but 36 are at State land-grant Agricultural Experiment Stations, three are in university laboratories, and five are in industry laboratories.

In 1976 and again in 1977, ERDA "passed through" to ARS some \$3.2 million for energy research. Some of the ARS projects require only some reduction of equipment cost or slightly higher fuel prices to become economically feasible on a widespread basis.

While we are stressing solar energy research development and demonstration needs here today, ARS scientists suggest that energy research also is needed which will:

-- Develop reduced or improved tillage systems to maintain crop production capacity and potential while lowering energy consumption in relation to crop output. The use of minimum tillage where it can be adopted is one way to do this. For example, the requirements of diesel fuel per acre for growing corn in eastern Nebraska has been reduced from 5.3 gallons per acre with conventional tillage to 2.5 gallons with minimum tillage operations.

-- Develop more efficient practices and technologies for application of pesticides to increase the effectiveness of coverage and control and to reduce energy and chemical use. USDA's Integrated Pest Management Program now conducted by the Extension Service is making progress in this area.

-- Develop improved cropping systems to make more efficient use of available fertilizer nutrients and maximize use of symbiotic and non-symbiotic nitrogen fixers. Involved here is selection for improved nitrogen fixers and introduction of nitrogen-fixing capabilities to non-leguminous crops.

-- Develop energy-conserving practices in livestock production. Solar energy will certainly emerge in climate control for buildings for livestock and for greenhouses.

-- Develop energy-conserving technologies and processes in wood and fiber manufacturing and in waste reduction. Of all the energy consumed in the U.S., about 2 percent is required by forest industries.

-- Develop technologies and practices for more efficient use of nonrenewable resources by substituting lumber and other forest products

in building and consumer goods. Lumber and other wood products can effectively substitute for building materials made from nonrenewable resources. Energy required to produce metal studs, laths, and siding is many times greater than that for producing similar wood products.

-- Develop techniques for converting forest residues into petrochemical substitutes. Forest residues of all types are generated at the rate of about 170 million tons annually.

The Department of Agriculture and the National Association of State Universities and Land Grant Colleges have established a USDA-State task force which has examined the subject of Energy for Agriculture. This task force inventoried existing research and identified additional needs for agricultural energy research and development to address the current problems and to meet future needs. The Cooperative State Research Service and its State client research institutions are intensely aware of the urgency for specific efforts in agriculture and the rural sector to deal with the energy crisis in ways to meet the Nation's needs for food and fiber.

The need for conservation of scarce energy sources in agriculture is well known by the leaders of the State Agricultural Experiment Stations with whom we work. During fiscal year 1975 the State stations' research effort on conservation and use of energy was roughly 40 scientist years. It is estimated that energy conservation research has risen by approximately 10 percent per year since that time. The task force and the agricultural research agencies consider it to be of great importance to develop financial support for a broader energy research effort than has been possible to date.

Three fields of energy research at the State stations which have received partial support during the last few years include:

1. Conservation and Use of Energy--Extensive work on tillage and practices to conserve fuels, fertilizers, pesticides and electricity, food and fuel, plus research on natural nitrogen fixation by plants and improved photosynthetic efficiency of production.

2. Solar Energy for Agricultural and Rural Uses--An extensive program of competitive grants on solar energy uses in the Experiment Stations organized jointly by ARS and CSRS and managed by ARS. The funding for the bulk of this program has been transferred to USDA by the Energy Research and Development Administration. It includes solar drying, heating of greenhouses and homes, and other on-farm uses of solar heat.

3. Environmental Effects of Energy Development--Includes reclamation research and studies of the impacts on land quality, water quality, and related environmental impacts from the increased use of non-critical domestic sources of energy such as coal, lignite, and oil shale. This research program, which is going forward in all regions of the U.S. where the energy resources are located, has been supported at a moderate level for many years by USDA and by State and private funding. During the past 2 years the research has been augmented by transfer of funds from the Environmental Protection Agency's Energy Program.

The Cooperative State Research Service is supporting a program of research grants on mineland reclamation in coal- and oil-producing States under an interagency agreement between the Environmental

Protection Agency and SCRS to develop improved methods of reclamation in energy development. Proposals received at CSRS by August 1, 1977, will be reviewed according to national needs, relevance to the task list in the research guidelines, available competence, and quality of the proposal. Four regional program directors and the coordinator will make up the review panel. Grants will be announced around August 15, 1977. Grants will be for no more than 2 years; they will range from \$20,000 to \$80,000 total funding.

The agriculture research establishment has the research capabilities and the rapid adaptability to respond to the energy challenge. In the experiment station system, through the demonstrated method of special grants for designated priority research categories, it is possible to rapidly mobilize needed talent in the fields of agricultural engineering, agronomy, microbiology, natural resource economics, processing, and marketing to produce the agricultural energy systems which this country will need to accommodate to the energy situation of the near future. I will encourage this talent to be so mobilized.

Cooperative Extension Service programs in energy conservation have been carried on as a part of our program to help increase the efficiency of farm and forestry operations; to adopt new technology, such as minimum tillage; to reduce costs and improve the quality of living by improved use of energy in the home; and as a part of community development programs to assist local governments to take action which will help to reduce energy use.

Extension is working on a solar energy education program aimed at reducing fuel costs for drying grain and providing energy when fossil fuel sources may no longer be available. The potential for solar grain drying, if technology can be perfected and fully utilized, is reflected in the fact that 664 million gallons of L.P. gas and over 77 million gallons of fuel oil, 27 billion cubic feet of natural gas, and 858 million KWH of electricity are used each year for grain drying in the Midwest alone. The amount of energy required for drying grain generally exceeds the amount required to produce it.

To summarize in relation to research and extension --

Research scientists in USDA, and their partners in the land grant universities, will give emphasis to:

1. Developing organizational systems, technology, and practices that make more efficient use of energy--that is--conserve energy used in producing, processing, transporting, and distributing food, fiber, and forestry products--and in facets of rural living.
2. Developing new forms of energy.
3. Adapting new forms of energy for use in agriculture and forestry and other rural areas.

Extension leaders throughout the joint USDA-university system will build upon the existing delivery system to:

1. Communicate new and useful existing knowledge.
2. Work with research leaders to set up and operate demonstration units on new techniques of capturing and utilizing energy.

Forest Service and Soil Conservation Service scientists and engineers also are working on relevant energy conservation and development projects.

There is an opportunity to achieve greater energy self-sufficiency in the forest and mill industries by using lower quality hardwoods and residues as fuel. Combustion of forest material can provide a significant part of our energy needs. Energy chemicals and petrochemical substitutes can be produced from wood. The Forest Service is a leader in environmental protection and reclamation technologies needed to accompany energy resource development. Wind protection and shade provided by tree plantings around buildings have been found to reduce energy requirements for heating in the winter by as much as 12 percent and for cooling in the summer by 20 percent.

The Forest Service has been selected to serve as the lead agency for the Department on the national Rural Development Committee (RDC) task force to assist in meeting the energy conservation needs of rural America's homes. This action is part of the Department's commitment to supporting the President's objectives to carry out a national program for energy conservation. Energy-saving activities will include using technical assistance and resources of other Federal agencies, universities, and State and local units of government. National guidelines and sample action plans will be developed by the staff group for the national RDC and agency field organizations that can be adapted by State and local RDC's to meet local needs. ARS will lead another task force to produce weatherization guidelines for existing housing. Local

field agency personnel will participate as members of local RDC's in disseminating information on energy-saving measures to the public.

Examples of energy conservation activities include --

-- weatherization of existing housing

-- planting trees to provide shade in the summer and protection in the winter

-- planting of farmstead windbreaks

-- using wood to supplement normal heating energy or total conversion to wood fuels

-- use of more energy-efficient heating facilities

-- encouraging service organizations and others to assist the poor, the aged, and the needy to participate in winterization programs.

Department agencies will transmit pertinent activity information to field staffs, initiate necessary technical and economic studies as priorities permit, and provide technical support and loan assistance within legislative and funding constraints.

Our soil conservationists have found that reduction of tillage methods could save hundreds of millions of gallons of gasoline (but require the use of more pesticides); that more efficient use of irrigation water would save additional hundreds of millions of gallons of fuel; that improved water supply forecasts could optimize the efficiency of water use; and that improved drainage of land in crops would also result in important fuel savings.

In summary, our Nation's food, fiber, and wood products system is energy-intensive and energy-dependent. Producing, Harvesting, processing,

distributing, and using these products consumes at least 22 percent of the energy used in the U.S. And that's a lot of energy.

The future will see a further increase in the relative cost of energy. There will be significant changes in the form and the geographic areas in which energy is available to agriculture--basically, more electric power, and less natural and L.P. gas.

In some areas of the Southwest the ability to convert from natural gas to electricity is not assured. Generating plant reserves are low.

In addition, nearly 80 percent of the electricity generated in the Southern Plains is obtained by burning natural gas. This practice must stop. Our premium quality fuel needs to be reserved for higher priority uses, including food processing.

Farmers and ranchers are to be commended for their wisdom and judgment in making a rapid adjustment to new ideas and practices in energy consumption which are practical and economically sound. One example has been the rapid move from gasoline- to diesel-powered units.

A suitable balance of trade, including agricultural commodities, to assure our ability to purchase foreign petroleum, is a key part of the U.S. energy picture. In recent years returns from the export of food, fiber, and forest products have made major contributions toward covering the Nation's costs for importing petroleum, petroleum products, and natural gas. An important part of this mix is that returns to farmers for their products need to be compatible with their energy costs, including costs for petroleum-based inputs such as fertilizers and pesticides. Thus, farm policy can't be developed independent of energy policy.

There's an interesting closed circle involved. We need energy to produce food, and we need food to purchase foreign oil.

Let me emphasize that the high-priority responsibilities of the publicly supported agricultural research system must include energy research. The system must not shirk this responsibility. It has a special capability to carry out an agricultural energy R&D program--to bring to bear the expertise, experience, and facilities of the entire system. It has a responsibility for: (1) Helping to ensure sufficient energy inputs--including fertilizers, pesticides, and other petroleum-based chemicals--for meeting agriculture's needs and (2) helping agriculture to contribute needed energy where it can.

There is need for early action to develop a comprehensive, balanced agricultural energy R&D program. As now conducted, energy R&D generally is not addressed to "sectors of the economy" such as agriculture. Agriculture is too important to the well-being of the Nation for this to continue. A laissez-faire approach of supplying adequate BTU's without regard to form, geographic distribution, or implications of energy for practices or procedures will not be enough.

It is vital for the Nation to have sufficient energy--sufficient BTU's--for all of its economic sectors. Parallel vital matters are (1) to understand how energy is used or produced in those sectors and, most importantly, (2) to devise ways to ensure that such critical sectors as agriculture will indeed be able to function.

The Senate recently passed a "farm bill" which contains important provisions regarding USDA's role in solar energy. The legislation calls for the Department to establish a nationwide information system on solar energy research projects related to agriculture. It provides for a program of competitive grants to persons and organizations for research on agricultural uses of solar energy. It provides authority for grants to establish at least one model farm in each State to demonstrate solar energy research projects. After 2 years it requires the establishment of not less than 10, on-farm demonstrations of solar energy in each State. The Act establishes regional solar energy research centers. All forms of solar energy are included in these provisions--energy from wind and biomass, as well as heat.

A bill under consideration in the House contains somewhat different provisions. Both bills would give USDA a definite role in solar energy research and extension.

As President Carter's National Energy Plan observes, "The prospect of America organizing to meet the energy crisis is not grim. It is exciting." The Plan also noted that, while "Washington can and must lead, . . . the Nation's real energy policy will be made in every city, town, and village in the country." It's up to us to provide the leadership, and I look forward to working with you toward achievement of the President's energy goals.

